

REMARKS

Claims 3, 4, 6-21 and 23-24 are pending in the application.

Claim Amendments

By this amendment, claim 23 is amended to clarify that the NOx and SOx regeneration control means are "separate" and "determined independently" from one another. No new matter is added by this amendment.

Interview with Examiner

Applicants thank the Examiner for the courtesy extended toward their representative during the interview of July 27, 2005. During the interview, the above amendment was discussed. No agreement was reached regarding the allowance of the claims.

Rejection of Claims 8-21 and 23 under 35 USC 103(a)

Claims 8-21 and 23 stand rejected under 35 USC 103(a) as being unpatentable over Murachi et al '989 in view of Hepburn '788.

In support of the rejection, the Examiner takes the position that Murachi et al teaches an exhaust gas purifying apparatus of an internal combustion engine comprised of (a) a light-off catalyst 5 provided in an exhaust passage, (b) exhaust gas purifying means 9 provided in the exhaust passage downstream of the light-off catalyst, (c) NOx control means 20,4 for repeatedly releasing NOx

adsorbed by the NO<sub>x</sub> catalyst every first interval (2 minutes) and SO<sub>x</sub> control means 20,4 repeatedly releasing SO<sub>x</sub> adsorbed by the NO<sub>x</sub> catalyst every second interval (every 60 minutes) *independent from and longer than the first interval.*

As admitted by the Examiner, Murachi et al fails to teach or suggest the limitation where the oxygen storage capability of the light-off catalyst is less than the oxygen storage capability of the three-way catalyst per one-liter volume of each catalyst as set forth in applicants' amended claim 23.

The limitation in claim 23 wherein the light-off catalyst "has limited O<sub>2</sub> storage capability such that the light-off catalyst passes therethrough at least CO in an exhaust gas to a downstream side of the light-off catalyst when the internal combustion engine is operating under a condition where the oxygen concentration of the exhaust gas is reduced" is also, contrary to the assertion of the Examiner, not taught by Murachi et al. Indeed, the Examiner's reliance upon the disclosure of Murachi et al (line 66 of column 3 to line 8 of column 4, and lines 29 to 38 of column 6) on this point is misplaced.

As is well known, a three-way catalyst exhibits acceptable exhaust gas purifying performance when the air-fuel ratio is close to the stoichiometric ratio, and it is further well known that the exhaust gas purifying performance deteriorates when the air-fuel

ratio is lean or rich. Namely, as is set forth at page 3, lines 8 to 25 of the specification, it is possible to feed HC and CO, which have not been purified by the light-off catalyst, downstream of the light-off catalyst by making the air-fuel ratio rich without reducing the oxygen storage capability.

Murachi et al operates in a manner consistent with the prior art as disclosed at page 3, lines 8-25 of the specification. As a result, the Examiner's view that Murachi et al discloses that the presence of HC or CO in the exhaust gas downstream of the light-off catalyst reduces the oxygen storage capability per one-liter volume of the light-off catalyst is not correct, and based on an assumption without factual basis.

Accordingly, Murachi et al neither discloses nor suggests the reduction of the oxygen storage capability per one-liter volume of the light-off catalyst.

With regard to the limitation directed to separate NOx and SOx control means, applicants disagree with the position of the Examiner.

Applicants acknowledge that Murachi et al teaches that a NOx release control is performed every first interval (2 minutes), and that a SOx release control is performed every second interval (60 minutes). The NOx release control and SOx release control are accordingly not performed independently of each other. Nor are

separate and independent NOx and SOx regeneration control means provided by Murachi - indeed, the Examiner makes reference to the same NOx/SOx control means 20,4 in support of the rejection.

Further, the Examiner states that, since in Murachi et al it is possible to release NOx even when the SOx release control is not taking place, the SOx release control and NOx release control in Murachi et al are independent from each other. The Examiner's position on this point is also without basis.

The expression "control is performed independently" in claim 23 means that a SOx release control is performed even under those conditions where NOx release control cannot be performed - in other words, wherein the instruction to perform a SOx release control and the instruction to perform a NOx release control are independent from each other.

Admittedly, in Murachi et al, when NOx release control and DPF regeneration control coincide, SOx release control is performed during the same period. The system is configured so that SOx release is automatically performed when both the command for NOx release and the command for SOx release are given. Indeed, there exists no teaching in Murachi et al regarding the use of control means to conduct SOx release control in the first place.

Thus, to perform SOx release, according to the teachings of Murachi et al, it is essential that NOx release also be performed

at the same time, with SO<sub>x</sub> release being impossible unless NO<sub>x</sub> release is also performed at the same time.

Accordingly, since, in Murachi et al, NO<sub>x</sub> release is essential for the execution of SO<sub>x</sub> release, it is not correct to consider that SO<sub>x</sub> release control and NO<sub>x</sub> release control are carried out independently from each other. This means that Murachi et al neither describes nor suggests the execution of NO<sub>x</sub> and SO<sub>x</sub> release control *independent from* each other as claimed by applicants.

With respect to claim 18, the Examiner appears to not specifically address the limitations of this claim. However, the Examiner previously acknowledged that the apparatus of Murachi et al fails to disclose the fact that the exhaust gas purifying means (9) has an oxygen storage capacity greater than that of the light-off catalyst (5). The Examiner previously stated that it is easy for those with ordinary skill in the art to reduce the oxygen storage capability of a light-off catalyst (5) that is of small size with respect to the exhaust gas purifying means (9). Applicants believe the conclusion of the Examiner to be without basis.

It is a matter of course that, when a catalyst is small, the oxygen storage capability for the entire volume of the catalyst becomes small as long as the oxygen storing material composition is the same. It should be noted, however, that what is discussed in

the invention of the present application is the oxygen storage capability *per one-liter volume of the catalyst*, and thus what is compared is not simply the amount of the oxygen component stored in the light-off catalyst (5) and that in the exhaust gas purifying means (9). In other words, even if the amount of the oxygen component stored in the light-off catalyst (5) is less than that in the exhaust gas purifying means (9), the oxygen storage capability of the light-off catalyst (5) can be higher than that of the exhaust gas purifying means (9). Hence, the prior conclusion of the Examiner used in support of the rejection of claim 18 is ill-founded.

The Examiner again recognizes that Murachi et al does not disclose the spark ignition type four-cycle engine set forth in claim 8. However, the Examiner states that "both 'spark-ignition engine' and 'diesel engine' generate exhaust gases containing the same harmful emissions". The Examiner accordingly takes the position that it would have been obvious to one having ordinary skill in the art at the time the invention was made to apply the invention of Murachi et al to a spark ignition type engine as claimed.

In response, applicants again disagree with the position of the Examiner. Certainly, the exhaust gas composition is similar for the diesel engine and the spark-ignition engine. However, one

of the main differences between the two types of engines lies in the fact that, while in the case of diesel engine soot is present, in the case of spark-ignition engine substantially no soot is present. Thus, while the diesel engine essentially requires a filter such as DPF, etc. for capturing soot, such a filter is not required for the spark-ignition engine and is accordingly not employed.

In the invention of Murachi et al, SOx release control is performed when the DPF regeneration control and the NOx release control coincide. But if the invention of the present invention relates to a spark-ignition engine, the DPF regeneration control is not present. In other words, the teachings of Murachi et al are not directly applicable to the spark-ignition engine of claim 8.

With regard to claim 9, rhw Examiner states that "the internal combustion engine is an in-cylinder type engine in which fuel is directly injected into a combustion chamber". However, claim 9 of the invention of the present application is dependent on claim 8 which is directed to the use of a gasoline engine. As discussed hereinabove, claim 8 of the invention of the present application cannot be easily arrived at from the teachings of Murachi et al, and claim 9, which is dependent on claim 8, is also distinguishable over the reference.

In view of the above, the rejection is without basis and should be withdrawn.

Rejection of Claims 3-4 and 6-7 under 35 USC 103(a)

Claims 3-4 and 6-7 stand rejected under 35 USC 103(a) as being unpatentable over Murachi et al in view of Hepburn '788 and design choice. This rejection respectfully is traversed.

With regard to claims 3-4, the Examiner acknowledges that Murachi et al fails to suggest the limitation where the difference in the amount of oxygen adsorbed on the light-off catalyst is not greater than 150 cc per one-liter volume of the catalyst, and the amount of oxygen stored in the light-off catalyst is not greater than 25 g per one-liter volume of the catalyst.

However, the Examiner takes the position that one of ordinary skill in the art could arrive at the claimed embodiment as it "would be a function of many variables such as the size of the light-off catalyst, engine size, engine operating conditions (load, speed, etc.), air and fuel properties, capacity and size of a main catalyst, etc." The Examiner also states that there is nothing in the specification which establishes that these claimed amounts of oxygen bring about unexpected results.

However, as is clearly set forth in Fig. 10 of the specification, with the amount of oxygen adsorbed on the light-off

catalyst being 150 cc per one-liter volume of the catalyst and the amount of oxygen component stored in the light-off catalyst being 25 g per one-liter volume of the catalyst, the time required for making the air-fuel ratio rich can be reduced as much as by 60% compared with the period obtained by a catalyst whose adsorbed amount of oxygen exceeds 300 cc per one-liter volume of the catalyst. This showing confirms that the claimed embodiment is in fact not a matter of routine experimentation or optimization as asserted by the Examiner. The Examiner fails to address this point which was previously argued by applicants. Nor has the Examiner presented a *prima facie* case of obviousness based on his dismissal of the limitations of the claims 3-4.

As to claims 6-7, the Examiner acknowledges that Murachi et al does not teach that an amount of oxygen absorbed on the three-way catalyst of the exhaust gas purifying means is not greater than about 150 cc per one liter volume of the catalyst, and that an oxygen component stored in the three-way catalyst is not greater than 25 g per one-liter volume of the catalyst.

However, the Examiner takes the position that one of ordinary skill in the art could arrive at the claimed embodiment as it "would be a function of many variables such as the size of the light-off catalyst, engine size, engine operating conditions (load, speed, etc.), air and fuel properties, capacity and size of a main

catalyst, etc." The Examiner also states that there is nothing in the specification which establishes that these claimed amounts of oxygen bring about unexpected results.

The Examiner's dismissal without factual basis of the limitations of claims 6-7 fails to present a *prima facie* case of obviousness.

The rejection is thus without basis and should be withdrawn.

**Rejection of Claim 24 over Murachi in view of Hepburn '788/'084**

Claim 24 stands rejected under 35 USC 103(a) as being unpatentable over Murachi et al in view of Hepburn '788 and '084. This rejection respectfully is traversed.

The Examiner takes the view that claim 24 can be easily derived in view of the combined teachings of Murachi et al and Hepburn. Hepburn teaches that SOx control is conducted after the NOx release control.

The basic issue to be addressed is whether the conditions under which SOx regeneration occurs in Hepburn meet the limitations of claim 24. Indeed, the references do not contemplate "maintaining the reduced oxygen concentration until the absorbed NOx in said NOx catalyst is reduced outside the temperature range where SOx is releasable" as recited in claim 24. As such, the rejection is without basis and should be withdrawn.

In view of the above amendments and remarks, withdrawal of all rejections and allowance of the application is earnestly solicited.

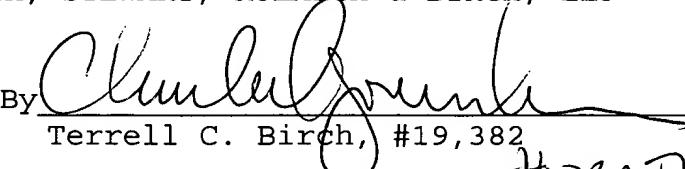
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact James W. Hellwege (Reg. No. 28,808) at the telephone number of the undersigned below.

A check in the amount of \$450.00 is attached as payment for the two-month extension of time.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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